

0008



**U. S. Steel
Mining Co., Inc.**

a Subsidiary of United States Steel Corporation

P. O. BOX 807
EAST CARBON, UTAH 84520
801 / 888-4431

*File
ACT/007/012
Folder no. 10
Revising Folder
COPY to Shannon
Tom P. Lynn*

WESTERN DISTRICT

JIM

SEP 19 1983

September 16, 1983

Mr. James W. Smith, Jr.
Coordinator of Mined Land Development
State of Utah
Division of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, Utah 84114

Attn: Shannon Storrud
Reclamation Engineer

Re: Proposed Modification to Refuse
Dikes - Wellington Coal Prep
Plant - ACT/007/012

Dear Mr. Smith:

U. S. Steel Mining Co.'s response to the biology and soil
comments are attached. The state engineer's comments have been
forwarded to Rollins, Brown and Gunnell for review.

Sincerely,

R. E. Yourston
General Superintendent

REY:VRW:cs
Enc.
cc: V. R. Watts
EC File

RECEIVED
SEP 19 1983

DIVISION OF
OIL, GAS & MINING

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DIVISION OF
OIL, GAS & MINING

U. S. STEEL MINING CO. RESPONSE

Biology and Soil Comments

UMC 517.21 Topsoil: General Requirements

- (a) As noted soils data submitted August 2nd (page 7) the A soil horizon was less than 6 inches thick. In the area of the diversion ditch the upper 6 inches of soil will be salvaged and stored in the topsoil storage pile. Any earth excavated to construct the ditch will be used to construct small embankments adjacent to the ditch. Therefore, the excavated subsoils will be available for reclamation.

In the area south of the Lower Refuse Dam the upper 6 inches of soil will be salvaged and stored in the topsoil pile as described in the application. The Wellington Coal Cleaning Plant reclamation Plan (contained in the Operation and Reclamation Plan) proposes to cover the refuse ponds with 18 inches of soil. Therefore, the Operator proposes to remove an additional 12 inches of subsoil and store it in the topsoil pile.

The soil electroconductivity reported was in error and should have been reported in units of micro mhos/cm. A copy of the soil description for RuB2 is attached.

UMC 817.23 Topsoil: Storage

The Operator proposes to seed the topsoil pile with the seed mix recommended by the vegetation study currently in progress (after approval by the Division). The vegetation consultant (Patrick Collins) retained by U. S. Steel Mining indicated that he does not see a need to mulch the topsoil pile. If inspections by the enforcement staff after seeding indicate a need, mulch will be added to the pile as required.

It is anticipated that the topsoil pile will be seeded in late fall (October-November) or early spring.

UMC 817.100 Contemporaneous Reclamation

Since the Lower Refuse Dike is being constructed out of minus 1½ inch refuse (rock), it would seem to be inappropriate to seed this area. The relatively coarse nature of this material should preclude any erosion problem on the slopes of the dike.

- C1g—11 to 17 inches, grayish-brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/6) and few, fine, faint, gray (N 6/0) mottles; weak, coarse, subangular blocky structure; slightly hard or hard, firm, slightly sticky and plastic; plentiful medium and fine roots; common medium and fine pores; strongly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.
- C2g—17 to 33 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; few, fine, distinct, strong-brown (7.5YR 5/6) mottles and common, medium, distinct, gray (N 6/0) mottles; weak, coarse, prismatic structure breaking to weak, coarse, subangular blocky structure; very hard, very firm, sticky and very plastic; plentiful medium and fine roots; few medium and common fine pores; numerous gypsum mycelia; strongly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.
- C3g—33 to 43 inches, grayish-brown (2.5Y 5/2) heavy loam, dark grayish brown (2.5Y 4/2) when moist; fine, distinct, strong-brown (7.5YR 5/6) mottles and common, medium, distinct, gray (N 6/0) mottles; massive; hard, firm, slightly sticky and plastic; few medium and fine roots; common fine and few medium pores; moderately calcareous; moderately alkaline (pH 8.3); gradual, wavy boundary.
- C4g—43 to 70 inches, light brownish-gray (2.5Y 6/2) heavy loam, dark grayish brown (2.5Y 4/2) when moist; common, medium, gray (N 6/0) mottles; massive; hard, firm, slightly sticky and plastic; few medium and fine roots; common fine and few medium pores; strongly calcareous; moderately alkaline (pH 8.2).

The content of lime ranges from 10 to 30 percent and is greatest near the surface. In the A1 horizons, hue is 2.5Y to 5Y; value ranges from 5 to 7 when the soils are dry and is 4 or 5 when they are moist; and chroma is 2 or 3. Distinct to prominent mottles are at depths of less than 20 inches. Gley colors are common in some areas at some depth below 36 inches. Thin layers of peaty material are on the surface in some areas. The part of the profile between 10 and 40 inches is silty clay loam to heavy loam, and contains 22 to 38 percent clay and less than 15 percent sand that is coarser than very fine sand. All of the upper 40 inches is about the same color.

Rafael silty clay loam (1 to 3 percent slopes) (Ra).—The profile of this soil is the one described as typical of the series. Distinct mottles typically are in the surface layer, but they are at a depth of as much as 20 inches in some places. Below 3 feet gleying increases with depth. The wettest areas commonly have a thin platy layer on the surface. This soil is moderately to strongly affected by salinity and is not affected to strongly affected by alkali.

Included in mapping were areas of Ferron silt loam. Also included were areas where the soil is strongly saline.

Drainage is poor, and permeability is slow. Roots penetrate deeply, but in most places they are concentrated in the surface layer and in the subsoil. Runoff is slow, and the susceptibility to erosion is slight. Fertility is increased by the high content of organic matter in the surface layer.

This soil is used for grazing. Some of the drier areas are used for growing meadow hay. (Capability unit VIIw-28, nonirrigated; Wet Meadow range site)

Ravola Series

The Ravola series consists of soils that are deep, medium textured, moderately permeable, and well drained. These

soils occupy moderate to large areas on alluvial fans, or flood plains, and in narrow alluvial valleys. They have formed in alluvium that washed from shale and sandstone. The vegetation is mainly galletagrass, shadscale and some greasewood. Elevations range from 4,000 to 6,500 feet. The annual rainfall is 6 to 11 inches, and the mean annual soil temperature is 47° to 54° F. The frost-free season is 110 to 160 days.

In a typical profile, the surface layer is light brownish gray, slightly hard, moderately calcareous loam about 9 inches thick. The underlying material is light brownish gray, moderately to strongly calcareous loam that in places is weakly stratified with layers of sandy loam or clay loam.

Nearly all areas have been cleared and are used for irrigated pasture, alfalfa, small grains, and corn. Some areas in the mouths of canyons, where air drainage is good enough to reduce the hazard of frost, are used for apple and peach orchards. Areas not cultivated are used for range.

Representative profile of a Ravola loam in a cultivated field, 2,000 feet west and 600 feet north of the SE corner of section 31, T. 17 S., R. 9 E., in Emery County Utah:

- Ap1—0 to 6 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, subangular blocky structure breaking to weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; plentiful fine and few large roots; common fine and medium continuous pores; moderately calcareous; mildly alkaline (pH 7.8); clear, smooth boundary.
- Ap2—6 to 9 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, subangular blocky structure breaking to weak, coarse, granular structure; hard, friable, slightly sticky and slightly plastic; plentiful fine roots; common fine and few medium pores; strongly compacted plowpan layer; moderately calcareous; mildly alkaline (pH 7.7); clear, smooth boundary.
- C1—9 to 18 inches, brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, thin, platy structure breaking to weak, very thin, platy structure; hard, friable, slightly sticky and slightly plastic; few large and plentiful fine roots; many large and common fine pores; moderately calcareous; mildly alkaline (pH 7.7); gradual, wavy boundary.
- C2—18 to 45 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, subangular blocky structure breaking to weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few large and plentiful fine roots; common large and many fine pores; strongly calcareous; moderately alkaline (pH 7.9); gradual, irregular boundary.
- C3—45 to 60 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; few fine pores; moderately calcareous; moderately alkaline (pH 7.9).

Ravola soils generally are dry when not frozen, unless they are irrigated. The content of calcium carbonate ranges from 5 to 25 percent. Reaction is mildly and moderately alkaline. Salinity ranges from slight to moderate. The clay mineralogy is mixed, but the clay is mainly illite. In the A horizon, the hue is 2.5Y to 5Y; value is 6 or 7 when the soils are dry and is 4 to 5 when they are moist; and chroma ranges from 2 to 4. In some places the A horizon is silty clay loam. The part of the profile between 10 and 40 inches is heavy loam, silt loam, or very fine sandy loam that contains 18 to 27 percent clay and less than 15 percent sand coarser than very fine sand. All of the upper 40 inches is

about the same color. Below a depth of 40 inches, the texture ranges from sandy loam to silty clay loam.

Ravola loam, 1 to 3 percent slopes (R1B).—In most places the profile of this soil is like the one described as typical of the series. In some places, however, the texture between depths of 10 and 40 inches is silt loam to very fine sandy loam and the texture below 40 inches is sandy loam to silty clay loam. Salinity generally is slight to moderate. Alkalinity ranges from none to moderate. Veins of gypsum are common below a depth of 20 to 30 inches. The frost-free season is 110 to 130 days in 3 out of 4 years.

Included in mapping were areas of Billings silty clay loam, and other areas $\frac{1}{2}$ acre to 1 acre in extent, of poorly drained, strongly or very strongly saline-alkali soils. Also included were areas of a soil that is brown or light olive in color, and areas of Ravola loam in which the slopes are slightly less than 1 percent.

Drainage is good, and permeability is moderate. Runoff is medium, and the susceptibility to erosion is moderate. Roots penetrate to a depth of 5 feet or more. This soil retains about 10.5 inches of water, but only about 6 inches of water is readily available to plants. Natural fertility is low, but the fertility in many fields is high because fertilizer has been applied. This soil is easy to work and to irrigate. The uniform distribution of irrigation water is needed. Land leveling can be done with little or no damage to the soil.

This soil is used for spring and fall range and for irrigated pasture, alfalfa, small grains, corn, and sugar beets. The growing season is long enough for alfalfa to produce two full cuttings and part of a third. Corn does not mature for grain and is used for ensilage. (Capability units IIe-2, irrigated, and VIIc-D, nonirrigated; Desert Loam Bottom range site)

Ravola loam, 1 to 3 percent slopes, eroded (R1B2).—Originally, this soil was similar to Ravola loam, 1 to 3 percent slopes, but erosion has formed V-shaped gullies 4 to 5 feet deep and 100 to 400 feet apart in it. These gullies were caused by runoff from nearly raw shale hills, or in some places by waste water from irrigation. Because of the gullies, some fields are no longer cultivated. The cultivated areas between the gullies are used in the same way as Ravola loam, 1 to 3 percent slopes. Careful use of irrigation water is needed. Areas within 15 to 20 feet of a gully should not be cultivated.

Areas of this soil that are not in cultivation are used for spring and fall range. The cultivated areas are used for irrigated pasture, alfalfa, small grains, and corn. (Capability units IIe-2, irrigated, and VIIe-D, nonirrigated; Desert Loam Bottom range site)

Ravola loam, 3 to 6 percent slopes, eroded (R1C2).—This soil is similar to Ravola loam, 1 to 3 percent slopes, except that it has steeper slopes and is eroded. It occupies alluvial fans.

Included in the mapping were similar soils that are moderately deep over shale and some soils that are moderately fine textured.

Runoff is rapid, and the susceptibility to erosion is high. Sheet erosion is active. The surface layer has been washed from the soils in the upper part of most fields and has been deposited on soils in the lower part. In many areas, especially near the steep, nearly bare shale hills, gullies

are 4 to 8 feet deep and 100 to 400 feet apart. Some gullies were started by water escaping through breaks in irrigation canals and laterals.

Many areas are used for spring and fall range. The cultivated areas are used for irrigated pasture, grains, and alfalfa. (Capability units IIIe-2, irrigated, and VIIe-D, nonirrigated; Desert Loam Bottom range site)

Ravola loam, 1 to 10 percent slopes, channeled (RnD).—This soil has an uneven surface that has been dissected and channeled by gullies that are now fairly well healed. It is limited in extent.

Runoff is rapid, and the susceptibility to erosion is high. Extensive leveling is needed before this soil can be cultivated. The soil is used for range. (Capability unit VIIe-D, nonirrigated; Desert Loam Bottom range site)

Ravola loam, extended season, 0 to 1 percent slopes (RsA).—This soil is similar to Ravola loam, 1 to 3 percent slopes, except that it is nearly level. In addition, it is in an area in which the growing season is 140 to 160 days. It occupies flood plains of the Green River.

Included in mapping were small areas of Billings silty clay loam and Green River loam.

Runoff is slow, and the susceptibility to erosion is slight. The uniform distribution of water is needed. Many fields have been leveled, but leveling is still needed in some places to improve the distribution of water.

This soil is used for irrigated pasture, alfalfa, small grains, corn, melons, and sugar beets. The growing season is long enough for corn to mature and for alfalfa to produce three full cuttings in a year. (Capability unit I-1, irrigated; not rated for other uses)

Ravola loam, extended season, 1 to 3 percent slopes (RsB).—This soil is similar to Ravola loam, 1 to 3 percent slopes, except that it is in an area in which the growing season is 140 to 160 days. This soil is near Green River.

Included in mapping were some low spots in which the soil has a surface layer of silty clay loam, and some small areas of similar soils that are brown.

The growing season is long enough for corn to mature and for alfalfa to produce three full cuttings in a year. This soil is used for irrigated pasture, alfalfa, small grains, corn, melons, and sugar beets. (Capability unit IIe-1, irrigated; not rated for other uses)

Ravola silty clay loam, 1 to 3 percent slopes (R1B).—This soil has a surface layer of silty clay loam 8 to 15 inches thick, and it is gravelly in a few places. Otherwise, it is similar to Ravola loam, 1 to 3 percent slopes.

The infiltration rate is moderate to slow. This soil is fairly hard to work. A seedbed is more easily prepared if the soil is plowed in fall when barely moist, and is allowed to remain rough over winter, than if it is plowed in spring. This soil compacts if it is trampled or cultivated when wet.

This soil is used for irrigated pasture, alfalfa, small grains, and corn. (Capability units IIe-2, irrigated, and VIIs-D, nonirrigated; Desert Loam Bottom range site)

Ravola-Bunderson complex, 1 to 3 percent slopes, eroded (RnB2).—About 80 percent of this mapping unit is Ravola loam, 1 to 3 percent slopes, eroded, and 20 percent is Bunderson loam, 1 to 3 percent slopes, eroded. Typically, the Bunderson soil occupies slickspots that are inter-

dispersed with areas of the Ravola soil (fig. 13). Both soils are on flood plains and alluvial fans.

Included in mapping were small areas of Billings silty clay loam.

Runoff is rapid from the Bunderson soil, and most areas contain gullies 5 to 20 feet deep and 500 to 1,300 feet apart. Head cutting is common, and it is forming shallow gullies. In places windblown hummocks less than 2 feet high occur. Typically, these are on the east and north sides of greasewood and other plants.

The soils in this mapping unit are suited to the production of range forage. Controlling gully erosion and regulating the amount and season of range use are needed. Clearing the brush and reseeding grasses are not feasible, because of the small amount of rainfall. (Both soils are in Capability unit VIIe-D, nonirrigated; Ravola soil is in Desert Loam Bottom range site).

Riverwash (Rv) consists of streambeds or riverbeds, including oxbow-loops and other channels. These areas are exposed at low water and subject to shifting during periods of high water because of deposition and erosion. The deposited materials are extremely variable, ranging from boulders in the upper part of streams to silt and clay in the lower, more nearly level areas. Most areas are channeled and have little or no cover of vegetation. (Capability unit VIIIw-4, nonirrigated; not rated for other uses)

Rock land (Ry) is a miscellaneous land type having a surface 50 to 70 percent covered by stones, boulders, and outcrops of shale and sandstone. Most of this land type is moderately eroded, but many areas are severely eroded. Soil characteristics are almost obscured by the stones and boulders. The slopes are very steep to perpendicular, but typically they are between 50 and 80 percent.

Included in mapping were gently sloping, deep fine sandy loams. Intermingled with the sandstone outcrops



Figure 13.—An area of Ravola-Bunderson complex, 1 to 3 percent slopes, eroded. The nearly bare, light-colored slickspots are the Bunderson soil.

were inclusions of shallow fine sandy loams. Also included on some of the north-facing slopes in the mountains along the west side of the survey area were small areas of an unidentified soil.

This land type has almost no value for farming, although some areas have a sparse cover of grass, sagebrush, pinon, and juniper. This vegetation grows on all exposures, but it is dominant on north and west exposures. Small areas are accessible to livestock and wildlife, but most of the land type is too steep and rocky for grazing. (Capability unit VIIIs-3, nonirrigated; not rated for other uses)

Saltair Series

Soils of the Saltair series are deep, poorly drained, very strongly saline, moderately fine textured, and nearly level to gently sloping. They occupy moderate to large areas on alluvial fans, on flood plains, and in narrow alluvial valleys. These soils have formed in alluvium derived from marine shale and sandstone. The vegetation is greasewood, saltgrass, and kochia, but bare surfaces are common. Elevations range from 4,000 to 6,500 feet. The annual rainfall is 6 to 11 inches, and the mean annual soil temperature is 47° to 54° F. The frost-free season is 110 to 160 days.

In a typical profile, the surface layer is light brownish-gray, strongly calcareous, very strongly saline silty clay loam about 7 inches thick. The underlying material is light brownish-gray and light-gray heavy silt loam that is very strongly saline in the upper part. Platy crusts of salt on the surface, underlain by layers of soft, granular material, are common. The content of salt is 2 percent or more within 20 inches of the surface.

This soil is used for range, but the quality of the forage is poor.

Representative profile of Saltair silty clay loam in a pasture, 1,200 feet north and 500 feet west of the SE. corner of section 13, T. 17 S., R. 9 E. in Emery County, Utah:

A11sa—0 to ½ inch, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, thin, platy structure breaking to moderate, fine, granular structure; soft, firm, very sticky and plastic; plentiful large roots; many medium and fine vesicular pores; strongly calcareous; strongly alkaline (pH 8.9); thin salt crust; clear, smooth boundary.

A12sa—½ inch to 7 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; many, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak to moderate, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; plentiful medium and fine roots; common medium and fine pores; strongly calcareous; moderately alkaline (pH 8.3); very strongly saline; efflorescent salt on many ped surfaces and in pores; clear, smooth boundary.

C1gsa—7 to 14 inches, light brownish-gray (2.5Y 6/2) heavy silt loam, grayish brown (2.5Y 5/2) when moist; common, fine, distinct, yellowish-brown (10YR 5/4) mottles and common, fine, faint, gray (N 5/0) mottles; weak, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common medium pores; strongly calcareous; very strongly saline; efflorescent salt on many ped surfaces and in pores; strongly alkaline (8.5); gradual, wavy boundary.

son soil is the one described as typical for the Bunderson series. Included in mapping were areas of Ravola loam.

The surface layer of the Bunderson soil is platy and is nearly impervious to water. As a result, permeability and infiltration are very slow, especially in the surface layer. At depths of 10 to 20 inches, permeability is moderate. The surface of the Bunderson soil is nearly bare, except for scattered greasewood and pickleweed plants. About 11 inches of water is retained by this soil, but only about 4.5 inches is readily available to plants because of the high salt content in the upper 18 inches of the profile. Tiny crystals of salt are in the surface layer.

Runoff is rapid, and the soils of this complex are highly susceptible to erosion, especially during summer thunderstorms of high intensity. Gullying is variable, but in most areas the gullies are 10 to 20 feet deep and 500 to 1,300 feet apart. In addition, gullies 4 to 8 feet deep are eroding in a branching pattern, and head cutting is common.

The soils are better suited to production of range forage than to other uses. Reseeding of grasses and clearing of brush are not practical, because of the inadequate amount of rain. Proper use of the range and the control of gully erosion are the main management requirements. Plants growing on the Bunderson soil have no forage value. (The Billings soil is in capability unit VIIe-D, nonirrigated; Desert Loam Bottom range site. The Bunderson soil is in capability unit VIIIs-7, nonirrigated; not rated for other uses)

Bunderson Series

The Bunderson series consists of well-drained, calcareous, medium-textured soils that are strongly affected by alkali. These soils are on alluvial fans, flood plains, and alluvial plains. They have formed in alluvium that washed from alkaline marine shale and sandstone. The vegetation is a sparse stand of pickleweed and greasewood. Most areas are bare and have a platy, nearly impermeable crust on the surface. Elevations range from 5,000 to 6,500 feet. The annual rainfall ranges from 6 to 11 inches, and the frost-free season ranges from 110 to 130 days. The mean annual soil temperature is between 47° and 54° F.

In a typical profile, the surface layer is light-gray to light brownish-gray, slightly hard loam about 4 inches thick. The underlying material is light brownish-gray silt loam and loam.

The Bunderson soils are used only for wildlife habitat.

Representative profile of Bunderson loam, 1 to 3 percent slopes, eroded, in a range area 1,400 feet east and 900 feet north of the SW. corner of section 25, T. 21 S., R. 6 E., in Emery County, Utah:

A11—0 to 1 inch, light-gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) when moist; moderate, medium, platy structure; hard, friable, nonsticky and slightly plastic; no roots; few medium and fine vesicular pores; strongly calcareous; moderately saline; very strongly alkaline (pH 9.3); abrupt, smooth boundary.

A12—1 to 4 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) when moist; moderate, thin, platy structure; slightly hard, friable, nonsticky and slightly plastic; few fine roots; few very fine pores; strongly calcareous; strongly saline; very strongly alkaline (pH 10.0); abrupt, smooth boundary.

C1—4 to 11 inches, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; few fine roots; few very fine pores; strongly calcareous; strongly saline; strongly alkaline (pH 8.7); clear, wavy boundary.

C2—11 to 18 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; massive; slightly hard, very friable, nonsticky and slightly plastic; few very fine roots; few, fine, discontinuous pores; strongly calcareous; strongly saline; moderately alkaline (pH 8.4); gradual, irregular boundary.

C3—18 to 31 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; massive; soft, very friable, nonsticky and slightly plastic; few very fine roots; few very fine pores; strongly calcareous; strongly saline; moderately alkaline (pH 8.0); clear, wavy boundary.

C4—31 to 38 inches, gray (2.5Y 6/1) silt loam, dark gray (2.5Y 4/1) when moist; massive; soft, friable, slightly sticky and plastic; few very fine roots; few very fine pores; strongly calcareous; strongly saline; moderately alkaline (pH 7.9); clear, wavy boundary.

C5—38 to 72 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, very friable, nonsticky and slightly plastic; few very fine roots; few fine pores; strongly calcareous; moderately saline; moderately alkaline (pH 7.9).

The content of exchangeable sodium ranges from 30 to 96 percent; it is greatest in the upper part of the profile and decreases with depth. Salinity ranges from moderate to strong. Lime content ranges from 5 to 25 percent. The soils are generally dry when not frozen. The A1 horizons have a hue of 2.5Y to 5Y; value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; and chroma ranges from 2 to 4. The part of the profile between 10 and 40 inches is loam or silt loam, which contains 18 to 27 percent clay and less than 15 percent sand coarser than very fine sand. Color of the upper 40 inches is about the same as that of the A1 horizons.

Bunderson soils occur with the Billings and Ravola soils. In this survey area, they were mapped only with these soils.

Cache Series

The Cache series consists of deep, fine-textured, poorly drained, very strongly saline, nearly level or gently sloping soils on flood plains and alluvial fans. These soils have formed in alluvium that washed mainly from shale. The present vegetation is a sparse growth of greasewood, saltgrass, and pickleweed. Elevations range from 4,000 to 6,500 feet. The annual rainfall is 6 to 11 inches, the mean annual soil temperature is 47° to 54° F., and the frost-free season is 110 to 160 days.

In a typical profile, the surface layer is light brownish-gray, platy or granular silty clay loam about 3 inches thick. The underlying material is light brownish-gray silty clay that is mottled and gleyed in the lower part. A very strong salt horizon is less than 20 inches below the surface.

The Cache soils have a water table that is 20 to 40 inches below the surface most of the year. These soils are used mainly for wildlife habitat.

Representative profile of Cache silty clay is a range area 2,300 feet north and 1,800 feet east of the SW. corner of section 21, T. 20, S., R. 16 E., in Grand County, Utah:

A11sa—0 to ½ inch, light brownish-gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, platy breaking to moderate,

SOIL SURVEY INTERPRETATIONS

PLR 34
 RECORD NO. _____ AUTHORITY: JLS-NRM DATE: 2-75 REVISED: _____ UNIT MODIFIER: 1 TO 1% SLOPES
 KIND OF UNIT: SERIES _____ UNIT NAME: BIRDPERSON LOAM

TYPICAL AND BRIEF SOIL DESCRIPTION:
 SOIL SERIES ARE VERY DEEP, WELL-DRAINED, CALCAREOUS, STRONGLY ALKALI SOILS FORMED IN ALLUVIAL FROM
 MARINE SHALES AND SANDSTONE ON ALLUVIAL FANS AND FLOOD PLAINS UNDER SPARSE STANDS OF RICKLEWEED AND
 GRASS. MOST IS 47 TO 54°F. MAP IS 6 TO 10 INCHES. FFP IS 110 TO 130 DAYS. A TYPICAL PROFILE HAS A LIGHT
 BROWN AND LIGHT BROWNISH-GRAY LOAM SURFACE LAYER 11 INCHES THICK. THE UNDERLYING LAYER IS LIGHT BROWNISH-
 GRAY SILT LOAM AND LOAM TO 60 INCHES OR MORE. SLOPES ARE 1 TO 3 PERCENT.

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	USDA TEXTURE	UNIFIED	AASHO	FRACT. > 3 IN. (PCT.)	PERCENT OF MATERIAL LESS THAN 3 IN. PASSING SIEVE				LIQUID LIMIT	PLASTICITY INDEX
					4	10	40	75		
0-11	L	CL, CL-ML	A-4	0	100	100	85-95	60-75	20-30	5-10
11-60	L	CL, CL-ML	A-4	0	100	100	85-95	60-75	20-30	5-10

DEPTH (IN.)	PERMEABILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN IN)	SOIL REACTION (pH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	CORROSION		EROSION FACTORS		WIND EROD. GROUP	AWC = 1.0 - 7.0 WSC = 2.0 - 4.0
						STEEL	CONCRETE	K	T		
0-11	0.05 - 0.2	0.02 - 0.12	> 9.0	8 - 16	LOW	HIGH	HIGH	.55	1	4L	PERMEABILITY IS SLOW
11-60	0.6 - 2.0	0.02 - 0.12	7.9 - 9.0	8 - 16	LOW	HIGH	HIGH	.55			

FLOODING	HIGH WATER TABLE			CEMENTED PAN		BEDROCK		SUSIDENCE		HYD GRP	POTENTIAL FROST ACTION
	DEPTH (FT)	KIND	MONTHS	DEPTH (IN)	HARDNESS	DEPTH (IN)	HARDNESS	INITIAL (IN)	TOTAL (IN)		
	> 6.0					> 60				D	LOW

FOOTNOTES	SANITARY FACILITIES	KEYING ONLY		FOOTNOTES	SOURCE MATERIAL
		FILL	151		
	MODERATE - PERCS SLOWLY		2		ROADFILL
			3		
			4		
			5		
	1-2%: MODERATE - SEEPAGE 2+%: MODERATE - SLOPE, SEEPAGE	SAND	201		SAND
			2		
			3		
			4		
			5		
	MODERATE - SEEPAGE	GRAVEL	211		GRAVEL
			2		
			3		
			4		
			5		
	SLIGHT	SOIL	221		TOPSOIL
			2		
			3		
			4		
			5		
	GOOD	PONDS	231		FOOTNOTES
			2		
			3		
			4		
			5		
	SLIGHT	DIKES	241		EVBNKMENTS
			2		
			3		
			4		
			5		
	MODERATE - LOW STRENGTH	PONDAC	251		EXCAVATED
			2		
			3		
			4		
			5		
	MODERATE - LOW STRENGTH	DRAIN	261		DRAINAGE
			2		
			3		
			4		
			5		
	MODERATE - LOW STRENGTH	IRRIG	271		IRRIGATION
			2		
			3		
			4		
			5		
	MODERATE - LOW STRENGTH	TERRAC	281		TERRACES
			2		
			3		
			4		
			5		
		WATERWAYS	291		GRASSES
			2		
			3		
			4		
			5		

REGIONAL INTERPRETATIONS
 ERODES EASILY, EXCESS SALT, EXCESS ALKALI

UNIT NAME: HENDERSON LOAN
UNIT MODIFIER: 1 TO 2% SLOPES

RECREATION

TECHNICAL CONTROL	FOOTNOTE
CAMP AREAS	1-2%: MODERATE - PERCS SLOWLY, DUSTY 2-4%: MODERATE - SLOPE, PERCS SLOWLY
PICNIC AREAS	MODERATE - DUSTY
PLAYGROUNDS	
PATHS AND TRAILS	

FOOTNOTE

CAPABILITY AND PREDICTED YIELDS - CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

CLASS-DETERMINING PHASE	CAPABILITY		NIRR		IRR														
	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	
ALL	SS																		

FOOTNOTE

WOODLAND SUITABILITY

CLASS-DETERMINING PHASE	ORD SYM	MANAGEMENT PROBLEMS					POTENTIAL PRODUCTIVITY		TREES TO PLANT
		EROSION HAZARD	EQUIP. LIMIT	SEEDLING MORTY.	WINDTH. HAZARD	PLANT COMPET.	IMPORTANT TREES	SITE INDEX	
							NONE		

FOOTNOTE

WIND BREAKS

CLASS-DETERMINING PHASE	SPECIES	HT	SPECIES	HT	SPECIES	HT	SPECIES	HT

FOOTNOTE

WILDLIFE HABITAT SUITABILITY

CLASS-DETERMINING PHASE	POTENTIAL FOR HABITAT ELEMENTS							POTENTIAL AS HABITAT FOR:				
	GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWOOD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLAND WILDLIFE	WOODLAND WILDLIFE	WETLAND WILDLIFE	PANGELAND WILDLIFE
ALL	V POOR	V POOR	V POOR	-	V POOR	V POOR	V POOR	V POOR	V POOR	V POOR	V POOR	V POOR

FOOTNOTE

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION)

COMMON PLANT NAME	PLANT SYMBOL (NLSPH)	PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS DETERMINING PHASE	

POTENTIAL PRODUCTION (LBS./AC. DRY WT):

FAVORABLE YEARS

NORMAL YEARS

UNFAVORABLE YEARS

FOOTNOTES

SYMBOL

FOOTNOTES